RADIO TEST REPORT

Test Report No. : 14173246H-A-R2

Applicant	:	**OPTEX Co., Ltd.**
Type of EUT	:	**Vehicle detection sensor**
Model Number of EUT	:	**OVS-02GT(GR)**
FCC ID	:	**DC9-OVS02**
Test regulation	:	**FCC Part 15 Subpart C: 2021**
Test Result	:	**Complied (Refer to SECTION 3)**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
9. The information provided from the customer for this report is identified in Section 1.
10. This report is a revised version of 14173246H-A-R1. 14173246H-A-R1 is replaced with this report.

Date of test: November 9 to 23, 2021,
March 4 and 22, 2022

Representative test engineer:
Yuichiro Yamazaki
Engineer

Approved by:
Tsubasa Takayama
Leader

CERTIFICATE 5107.02

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc..
☒ There is no testing item of "Non-accreditation".

REVISION HISTORY

Original Test Report No.: 14173246H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	14173246H-A	January 24, 2022	-	-
1	14173246H-A-R1	March 24, 2022	P.1	Addition of the Date of test in cover page by the additional test.
1	14173246H-A-R1	March 24, 2022	P.1, 5	Correction of Model Number of EUT; from OVS-02GT(BL) to OVS-02GT(GR)
1	14173246H-A-R1	March 24, 2022	P.6	Changes in content due to correction of "Model Number of EUT"
1	14173246H-A-R1	March 24, 2022	P.7	- Deletion of the following sentence from Clause 3.2; *1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line. - Changed "* 2)" to "* 1)" due to the above correspondence.
1	14173246H-A-R1	March 24, 2022	P.7	Correction of the worst margin for Fundamental Emission in Clause 3.2 by the additional test; from 20.7 dB (24070.72 MHz) to 15.5 dB (24228.89 MHz
1	14173246H-A-R1	March 24, 2022	P.7	Correction of the worst margin for Spurious Emission in Clause 3.2 by the additional test; from 0.5 dB (96930.690 MHz, Horizontal, AV) to 2.1 dB (96878.90 MHz, Horizontal, PK with Duty factor)
1	14173246H-A-R1	March 24, 2022	P.10	Addition of the Test mode (Frequency sweep stopped) in Clause 4.1 by the additional test.
1	14173246H-A-R1	March 24, 2022	P.15	Correction of the formula for Distance Factor from 20 x log (4.0 m*/3.0 m) = 2.5 dB to 20 x log (3.75 m*/3.0 m) = 1.94 dB
1	14173246H-A-R1	March 24, 2022	P.21, 23	Replacement of the test data and test date by the additional test.
1	14173246H-A-R1	March 24, 2022	P.30	Addition of Test equipment by the additional test.
1	14173246H-A-R1	March 24, 2022	P.35	Correction of the Worst Axis; - from X-axis (0 deg) to Y-axis (0 deg) for 30 MHz - 40 GHz - from Z-axis (0 deg) to Y-axis (0 deg) for 40 GHz - 50 GHz
2	14173246H-A-R2	March 29, 2022	P.21	Addition of the following sentence; * Worst case was applied for the Duty factor.

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation
AC	Alternating Current
AFH	Adaptive Frequency Hopping
AM	Amplitude Modulation
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
Cal Int	Calibration Interval
CCK	Complementary Code Keying
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
D-factor	Distance factor
DFS	Dynamic Frequency Selection
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
DUT	Device Under Test
EDR	Enhanced Data Rate
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EN	European Norm
ERP, e.r.p.	Effective Radiated Power
ETSI	European Telecommunications Standards Institute
EU	European Union
EUT	Equipment Under Test
Fac.	Factor
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
Freq.	Frequency
FSK	Frequency Shift Keying
GFSK	Gaussian Frequency-Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Hori.	Horizontal
ICES	Interference-Causing Equipment Standard
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
ILAC	International Laboratory Accreditation Conference
ISED	Innovation, Science and Economic Development Canada
ISO	International Organization for Standardization
JAB	Japan Accreditation Board
LAN	Local Area Network
LIMS	Laboratory Information Management System
MCS	Modulation and Coding Scheme
MRA	Mutual Recognition Arrangement
N/A	Not Applicable
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
OBW	Occupied BandWidth
OFDM	Orthogonal Frequency Division Multiplexing
P/M	Power meter
PCB	Printed Circuit Board
PER	Packet Error Rate
PHY	Physical Layer
PK	Peak
PN	Pseudo random Noise
PRBS	Pseudo-Random Bit Sequence
PSD	Power Spectral Density
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadrature Phase Shift Keying
RBW	Resolution BandWidth
RDS	Radio Data System
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RNSS	Radio Navigation Satellite Service
RSS	Radio Standards Specifications
Rx	Receiving
SA, S/A	Spectrum Analyzer
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
TR, T/R	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN

CONTENTS **PAGE**

SECTION 1: Customer Information

Company Name	:	OPTEX Co., Ltd.
Address	:	5-8-12 Ogoto Otsu Shiga 520-0101 Japan
Telephone Number	:	+81-77-579-8000
Contact Person	:	Hiroaki Nakamura

The information provided from the customer is as follows;
- Applicant, Type of EUT Model Number of EUT, FCC ID on the cover and other relevant pages- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type	:	Vehicle detection sensor
Model Number	:	OVS-02GT(GR)
Serial Number	:	Refer to SECTION 4.2
Receipt Date	:	November 2, 2021
Condition	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: OVS-02GT(GR) (referred to as the EUT in this report) is a Vehicle detection sensor.

General Specification

Rating	:	AC 12.0 V / 24.0 V DC 12.0 V / 24.0 V
Clock frequency(ies) in the system	:	20 MHz (External)

Radio Specification

[Microwave Specification]

Radio Type	:	Transceiver
Frequency of Operation	:	24.15 GHz
Modulation	:	FMCW, CW
Antenna Type	:	24GHz patch antenna array
Antenna Connector	:	None
Antenna Gain	:	11 dBi
Steerable Antenna	:	None
Usage location	:	Fixed use

[Bluetooth Specification]*

Frequency of Operation	:	2402 MHz - 2480 MHz
Type of Modulation	:	GFSK

*The BLE module is a FCC certificated module.
This EUT uses only BLE.

Models OVS-02GT(BL), OVS-02RS(GR), OVS-02BRS(GR) and OVS-02B(GR) are same as tested model OVS-02GT(GR) except for model designation, use application.
These differences do not affect the test results.
Therefore, all tests were conducted on representative Model OVS-02GT(GR).
Model OVS-02GT(GR) was used for investigation purposes and was considered representative of all models covered by this report.

SECTION 3: Test specification, methods & procedures

3.1 Test specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz and 24.0-24.25 GHz

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Deviation	Worst margin	Results
1	Conducted Emission	ANSI C63.10-2013 6. Standard test methods	Section 15.207(a)	N/A	15.71 dB 2.44383 MHz AV, Phase N	Complied a)
2	Electric Field Strength of Fundamental Emission	ANSI C63.10-2013 6. Standard test methods	Section 15.249(a)(c)(e)	N/A	15.5 dB (24228.89 MHz, Vertical, PK with Duty Factor)	Complied b)
3	Electric Field Strength of Spurious Emission	ANSI C63.10-2013 6. Standard test methods 9. Procedures for testing millimeter-wave systems	Section 15.205(a)(b)(d) Section 15.209(a) Section 15.249(a)(c)(d)(e)	N/A	2.1 dB (96878.90 MHz, Horizontal, PK with Duty Factor)	Complied# c)
4	20 dB Bandwidth	ANSI C63.10-2013 6. Standard test methods	FCC 15.215	N/A	N/A	Complied d)
5	Frequency Tolerance	ANSI C63.10-2013 6. Standard test methods	Section 15.249(b)	N/A	N/A	N/A *1)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not required since this EUT does not point- to- point operation with 24.05 GHz to 24.25 GHz

a) Refer to APPENDIX 1 (data of Conducted Emission)
b) Refer to APPENDIX 1 (data of Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission))
c) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99% Occupied Bandwidth)

Symbols:
Complied The data of this test item has enough margin, more than the measurement uncertainty.
Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

FCC Part 15.31 (e)
This EUT provides stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition, deviation, exclusion to standards

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.

Ise EMC Lab.

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz - 0.15 MHz	2.9 dB
0.15 MHz - 30 MHz	3.4 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3 m	3.3 dB
10 m	3.2 dB

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	5.0 dB	6.3 dB	4.8 dB	5.0 dB

Radiated emission (Above 1 GHz)					
(3 m*) (+/-)		(1 m*) (+/-)		(0.5 m*) (+/-)	(10 m*) (+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	26.5 GHz - 40 GHz	1 GHz - 18 GHz
4.9 dB	5.2 dB	5.5 dB	5.5 dB	5.5 dB	5.2 dB

*Measurement distance

Radiated emission (+/-)		Distance
40 GHz - 50 GHz	4.1 dB	> =0.5 m
50 GHz - 75 GHz	5.1 dB	> =0.5 m
75 GHz - 110 GHz	5.4 dB	> =0.5 m

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919
ISED Lab Company Number: 2973C / CAB identifier: JP0002
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-

* Size of vertical conducting plane (for Conducted Emission test): 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Test Item	Mode	Tested frequency
- Conducted Emission - Radiated Emission (Electric Field Strength of Spurious Emission) - 20 dB Bandwidth, 99 % Occupied Bandwidth - Duty Cycle	Normal operating mode	24.15 GHz
- Radiated Emission (Electric Field Strength of Fundamental Emission and Spurious Emission)	Test mode (Frequency sweep stopped)	24.245 GHz

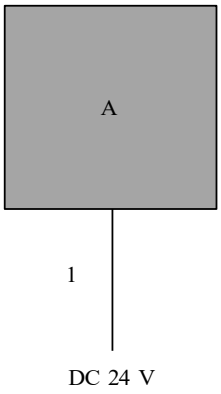
The system was configured in typical fashion (as a customer would normally use it) for testing.

*EUT has the power settings by the software as follows;
Power Settings: Same as Production model
Software: Sensor Program, Ver.0.3.22
(Date: October 29, 2021, Storage location: EUT memory)

*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.

4.2 Configuration and peripherals

[Other tests except for Conducted emission test]



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

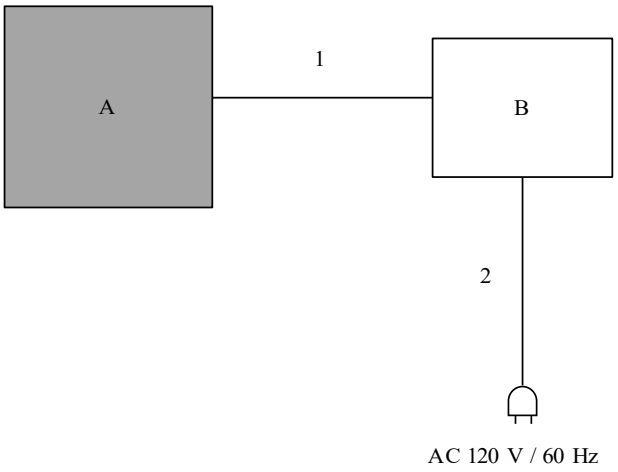
Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Vehicle detection sensor	OVS-02GT(GR)	No.08	OPTEX Co., Ltd.	EUT

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.5	Unshielded	Unshielded	-

[Conducted emission test]



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support Equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Vehicle detection sensor	OVS-02GT(GR)	No.08	OPTEX Co., Ltd.	EUT
B	DC Power Supply	PL330QMD	48943	Thurlby Thandar Instruments Limited	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.0	Unshielded	Unshielded	-
2	AC Cable	1.8	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

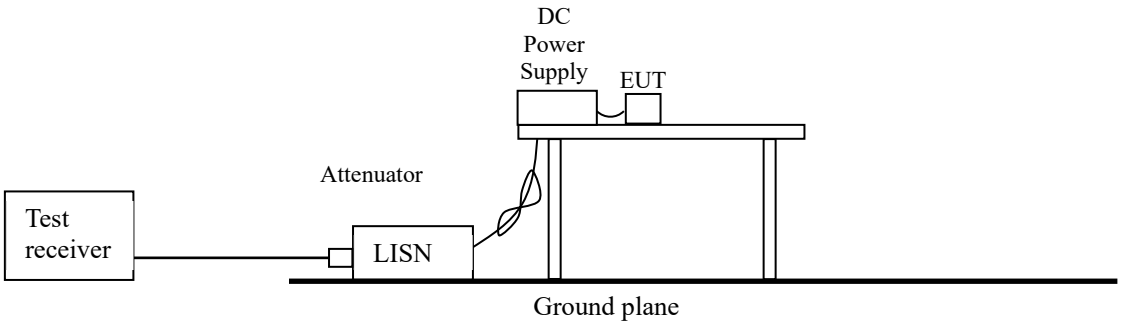
For the tests on EUT with other peripherals (as a whole system)
I/O cable and AC cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber or a Measurement Room.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Detector : QP and CISPR AV
Measurement range : 0.15 MHz - 30 MHz
Test data : APPENDIX
Test result : Pass

Figure 1: Test Setup



SECTION 6: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

[For below 30 MHz]
EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., 135 deg and 180 deg.) and horizontal polarization.
*Refer to Figure 1 about Direction of the Loop Antenna.

[For below 1 GHz]
EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz, up to 40 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 m and 4 m (frequency range 9 kHz - 30 MHz: loop antenna was fixed height at 1.0 m) and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear voltage average mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

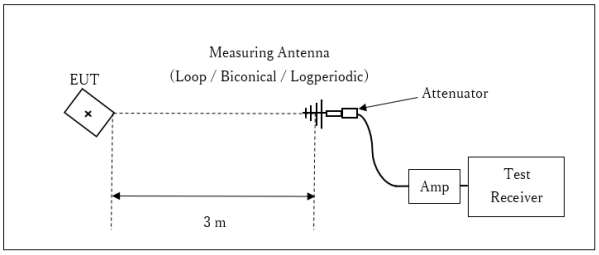
Frequency	9 kHz - 150 kHz	150 kHz - 30 MHz	30 MHz - 1 GHz	1 GHz - 40 GHz	
Instrument used	Test Receiver	Test Receiver	Test Receiver	Spectrum Analyzer	
Detector	QP, Average *1)	QP, Average *1)	QP	Peak	Average *2)
IF Bandwidth	BW 200 Hz	BW 9 kHz	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Pulsed emission - RBW: 1 MHz - VBW: 3 MHz - Peak with duty Other than above - RBW: 1 MHz - VBW: 10 Hz or 1/T_{ON} - Voltage avg.

*1) Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

*2) For Pulsed emission (Fundamental and band-edge): The Average value was calculated by reducing Duty factor from Peak (Peak value – Duty factor). For Duty factor, please refer to page Duty factor measurement. Other than pulsed emission, a VBW was set to 10 Hz and linear voltage average mode was used.

[Test setup]

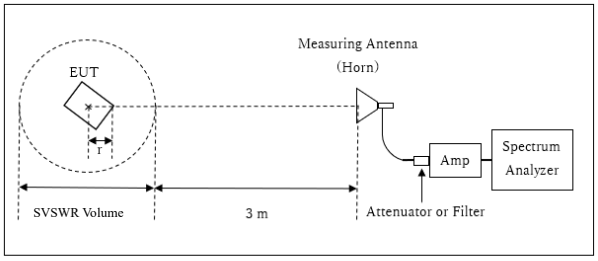
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



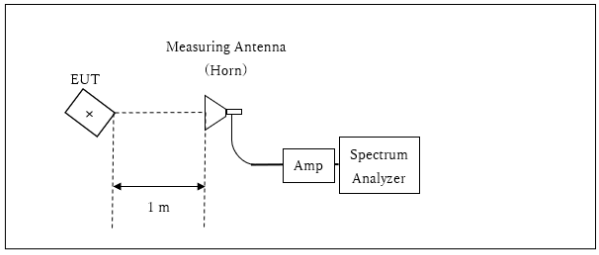
r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.75 m*/3.0 m) = 1.94 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.75 m

SVSWR Volume: 1.5 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0 m

* The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.

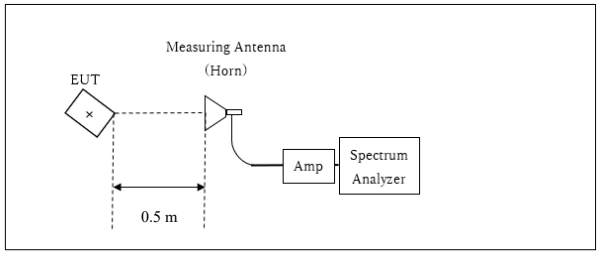
10 GHz - 26.5 GHz



× : Center of turn table

Distance Factor: 20 x log (1.0 m* / 3.0 m) = -9.5 dB
*Test Distance: 1.0 m

26.5 GHz - 40 GHz

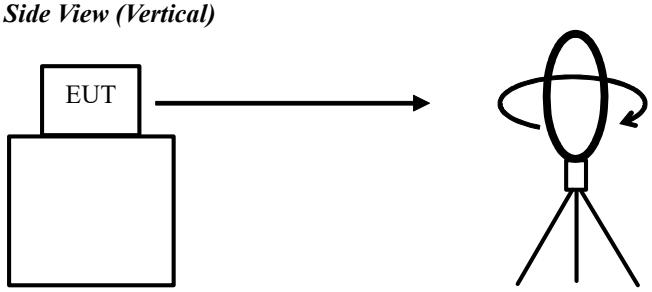


× : Center of turn table

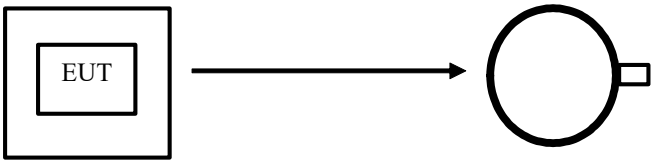
Distance Factor: 20 x log (0.5 m* / 3.0 m) = -15.6 dB
*Test Distance: 0.5 m

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

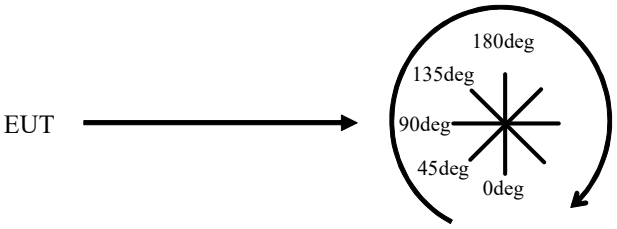


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

[About fundamental measurement]
The carrier levels were confirmed at maximum direction of transmission. The maximum direction was searched under carefully since beam-widths are narrow.

The carrier levels were measured in the far field. The distance of the far field was calculated from follow equation.

$$r = \frac{2D^2}{\lambda}$$

where

r is the distance from the radiating element of the EUT to the edge of the far field, in m
D is the largest dimension of both the radiating element and the test antenna (horn), in m
(The antenna aperture size of test antenna was used for this caluculation.)
Lambda is the wavelength of the emission under investigation [300 / *f* (MHz) * 10^3], in millimeter

Frequency	Wavelength	Maximum Aperture Dimention			Far Field
		EUT	Test Antenna	Maximum	Boundary
	Lambda		(MHA-02)	*D*	*r*
[GHz]	[mm]	[m]	[m]	[m]	[m]
24.250	12.4	0.035	0.038	0.038	0.234

[Above 40 GHz]
The test was performed based on "Procedures for testing millimeter-wave systems" of ANSI C63.10-2013. The EUT was placed on an urethane platform, raised 1.5 m above the conducting ground plane. The measurements were performed on handheld method.

Set spectrum analyzer RBW, VBW, span, etc., to the proper values. Note these values. Enable two traces—one set to "clear write," and the other set to "max hold." Begin hand-held measurements with the test antenna (horn) at a distance of 1 m from the EUT in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 m from the EUT. Observation of the two active traces on the spectrum analyzer will allow refined horn positioning at the point(s) of maximum field intensity. Repeat with the horn in a vertically polarized position. If the emission cannot be detected at 1 m, reduce the RBW to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

Note the maximum level indicated on the spectrum analyzer. Adjust this level, if necessary, by the antenna gain, conversion loss of the external mixer and gain of LNA used, at the frequency under investigation. Calculate the field strength of the emission at the measurement distance from the Friis' transmission equation.

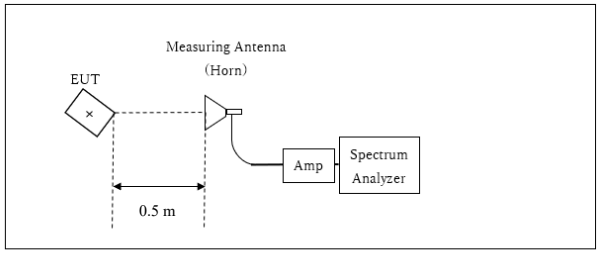
Frequency	40 GHz to 50 GHz,	50 GHz to 75 GHz	75 GHz to 100 GHz
Final measurement distance with 1 MHz Peak detector	0.5 m	0.75 m	0.5 m

Detector	Peak	Average *1)	
IF Bandwidth	RBW: 1 MHz VBW: 3 MHz	Pulsed emission - RBW: 1 MHz - VBW: 3 MHz - Peak with duty	Other than pulsed - RBW: 1 MHz - VBW: 10 Hz - Voltage avg.

*1) For Pulsed emission: The Average value was calculated by reducing Duty factor from Peak (Peak value - Duty factor). For Duty factor, please refer to page Duty factor measurement. Other than pulsed emission, a VBW was set to 10 Hz and linear voltage average mode was used.

[Test setup]

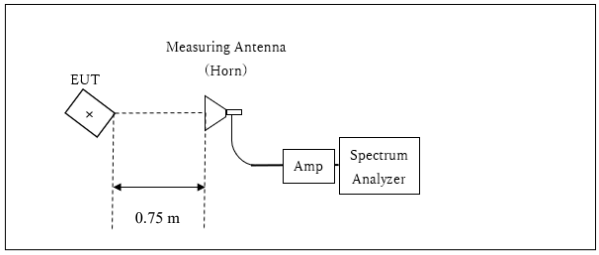
40 GHz - 50 GHz



× : Center of turn table

Distance Factor: 20 x log (0.5 m / 3.0 m) = -15.6dB
*Test Distance: 0.5 m

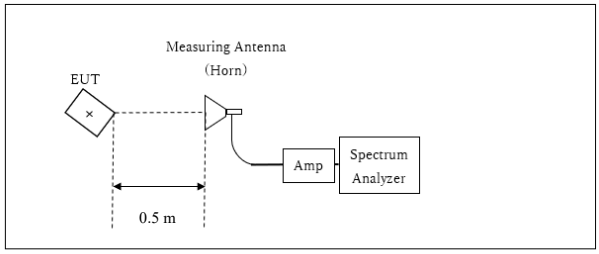
50 GHz - 75 GHz



× : Center of turn table

Distance Factor: 20 x log (0.75 m / 3.0 m) = -12.0 dB
*Test Distance: 0.75 m

75 GHz - 100 GHz



× : Center of turn table

Distance Factor: 20 x log (0.5 m / 3.0 m) = -15.6 dB
*Test Distance: 0.5 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 9 kHz - 100 GHz
Test data : APPENDIX
Test result : Pass

SECTION 7: 20 dB Bandwidth, 99 % Occupied Bandwidth and Duty Cycle

Test Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	600 MHz	2 MHz 1 % to 5 % of OBW	6 MHz Three times of RBW	200 sec	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	600 MHz, Enough width to display emission skirts	2 MHz, 1 % to 5 % of OBW	6 MHz, Three times of RBW	200 sec	Peak *1)	Max Hold *2)	Spectrum Analyzer
Duty Cycle	Zero	8 MHz	50 MHz	400 usec 1.1 msec 27.33 msec	Peak	Single	Spectrum Analyzer
*1) Peak detector was applied as Worst-case measurement. *2) The measurement was performed with Max Hold since the duty cycle was not 100 %.							

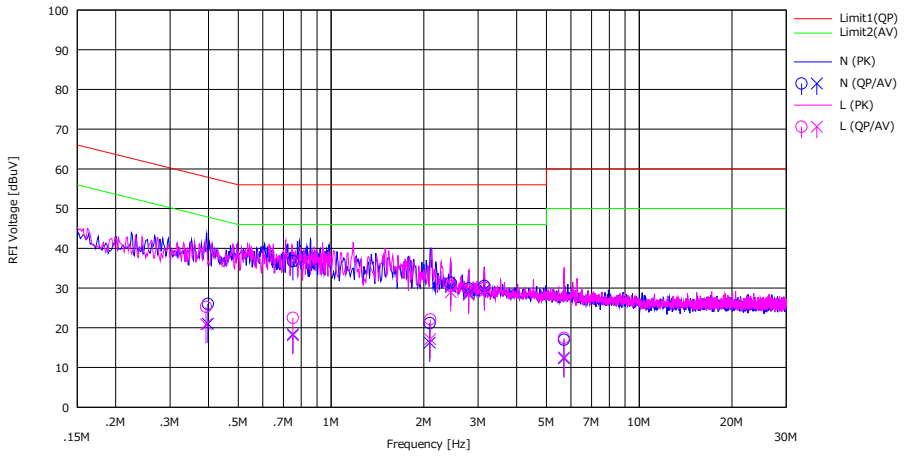
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Report No.	14173246H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	November 24, 2021
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Junki Nagatomi
Mode	Normal Operating mode

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq.	Reading ⟨QP⟩	Reading ⟨AV⟩	LISN	LOSS	Results ⟨QP⟩	Results ⟨AV⟩	Limit ⟨QP⟩	Limit ⟨AV⟩	Margin ⟨QP⟩	Margin ⟨AV⟩	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.39831	12.70	7.70	0.08	13.22	26.00	21.00	57.89	47.89	31.89	26.89	N	
2	0.75160	23.40	5.00	0.09	13.26	36.75	18.35	56.00	46.00	19.25	27.65	N	
3	2.08995	7.70	2.80	0.11	13.36	21.17	16.27	56.00	46.00	34.83	29.73	N	
4	2.44383	17.90	16.80	0.11	13.38	31.39	30.29	56.00	46.00	24.61	15.71	N	
5	2.79492	16.40	15.10	0.12	13.40	29.92	28.62	56.00	46.00	26.08	17.38	N	
6	3.14372	17.00	16.00	0.12	13.42	30.54	29.54	56.00	46.00	25.46	16.46	N	
7	5.69756	3.30	-1.40	0.16	13.53	16.99	12.29	60.00	50.00	43.01	37.71	N	
8	0.39275	11.90	7.50	0.13	13.22	25.25	20.85	58.01	48.01	32.76	27.16	L	
9	0.75160	9.10	4.70	0.15	13.26	22.51	18.11	56.00	46.00	33.49	27.89	L	
10	2.09755	8.60	3.60	0.16	13.36	22.12	17.12	56.00	46.00	33.88	28.88	L	
11	2.44572	16.90	15.40	0.17	13.38	30.45	28.95	56.00	46.00	25.55	17.05	L	
12	2.79424	16.00	14.70	0.18	13.40	29.58	28.28	56.00	46.00	26.42	17.72	L	
13	3.14736	16.50	15.50	0.18	13.42	30.10	29.10	56.00	46.00	25.90	16.90	L	
14	5.70231	3.70	-1.20	0.23	13.53	17.46	12.56	60.00	50.00	42.54	37.44	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Report No.	14173246H			
Test place	Ise EMC Lab.			
Semi Anechoic Chamber	No.2	No.4	No.4	No.4
Date	November 22, 2021	November 24, 2021	March 4, 2022	March 22, 2022
Temperature / Humidity	21 deg. C / 56 % RH	22 deg. C / 38 % RH	22 deg. C / 36 % RH	22 deg. C / 30 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	(1 GHz - 40 GHz)	(9 kHz - 1 GHz)	(18 GHz - 26.5 GHz)	(40 GHz - 100 GHz)
Mode	Tx			

[Fundamental, band-edge, harmonics]

Peak

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result (3 m) [dBuV/m]		Limit (3 m)	Margin [dB]		Remark
[MHz]		Hori.	Vert.	[dB/m]	[dB]	[dB]	[dB]	Hori.	Vert.	[dBuV/m]	Hori.	Vert.	
24000.00	Peak	43.2	43.5	40.4	-3.9	25.1	-	54.5	54.8	73.9	19.4	19.1	Inside of Restricted Bands
24228.89	Peak	101.1	101.9	40.3	-1.2	32.5	-	107.8	108.6	127.9	24.7	24.6	Fundamental
24250.00	Peak	43.9	43.5	40.3	-3.8	25.1	-	55.3	55.0	73.9	18.6	18.9	Outside of Restricted Bands
48443.67	Peak	64.2	63.1	41.7	-6.7	32.7	-	66.6	65.5	87.9	21.3	22.5	2nd Harmonics
72665.38	Peak	43.1	44.3	43.1	6.1	21.0	-	71.3	72.5	87.9	16.6	15.4	3rd Harmonics
96878.90	Peak	62.2	61.6	45.6	-4.4	35.6	-	67.9	67.3	73.9	6.0	6.6	4th Harmonics

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance Factor) - Gain(Amprifier)

Peak with Duty factor

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result (3 m) [dBuV/m]		Limit (3 m)	Margin [dB]		Remark
[MHz]		Hori.	Vert.	[dB/m]	[dB]	[dB]	[dB]	Hori.	Vert.	[dBuV/m]	Hori.	Vert.	
24000.00	Peak	43.2	43.5	40.4	-3.9	25.1	-16.1	38.4	38.7	53.9	15.5	15.2	Inside of Restricted Bands
24228.89	Peak	101.1	101.9	40.3	-1.2	32.5	-16.1	91.7	92.5	107.9	16.2	15.5	Fundamental
24250.00	Peak	43.9	43.5	40.3	-3.8	25.1	-16.1	39.2	38.9	53.9	14.7	15.0	Outside of Restricted Bands
48443.67	Peak	64.2	63.1	41.7	-6.7	32.7	-16.1	50.5	49.4	67.9	17.4	18.6	2nd Harmonics
72665.38	Peak	43.1	44.3	43.1	6.1	21.0	-16.1	55.2	56.4	67.9	12.7	11.5	3rd Harmonics
96878.90	Peak	62.2	61.6	45.6	-4.4	35.6	-16.1	51.8	51.2	53.9	***2.1***	2.7	4th Harmonics

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance Factor) - Gain(Amprifier) + Duty factor (Refer to Duty factor data sheet)

* Worst case was applied for the Duty factor.

[Spurious emissions other than above]

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	33.178	QP	22.7	17.4	7.2	32.3	15.0	40.0	25.0	
Hori.	63.925	QP	23.2	7.0	7.6	32.3	5.5	40.0	34.5	
Hori.	175.995	QP	22.4	16.0	8.6	32.2	14.9	43.5	28.6	
Hori.	293.191	QP	23.0	13.7	9.5	32.1	14.1	46.0	31.9	
Hori.	500.333	QP	22.2	18.0	10.7	32.1	18.8	46.0	27.2	
Hori.	699.936	QP	22.1	19.9	11.6	32.1	21.5	46.0	24.5	
Vert.	33.178	QP	22.7	17.4	7.2	32.3	15.0	40.0	25.0	
Vert.	63.925	QP	34.7	7.0	7.6	32.3	17.0	40.0	23.0	
Vert.	175.995	QP	22.4	16.0	8.6	32.2	14.9	43.5	28.6	
Vert.	289.185	QP	23.0	13.7	9.5	32.1	14.1	46.0	31.9	
Vert.	500.333	QP	22.2	18.0	10.7	32.1	18.8	46.0	27.2	
Vert.	699.936	QP	22.1	19.9	11.6	32.1	21.5	46.0	24.5	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor:

1 GHz - 10 GHz	20log (3.75 m / 3.0 m) = 1.94 dB
10 GHz - 26.5 GHz	20log (1.0 m / 3.0 m) = -9.5 dB
26.5 GHz - 50 GHz	20log (0.5 m / 3.0 m) = -15.6 dB
50 GHz - 75 GHz	20log (0.75 m / 3.0 m) = -12.0 dB
75 GHz - 100 GHz	20log (0.5 m / 3.0 m) = -15.6 dB

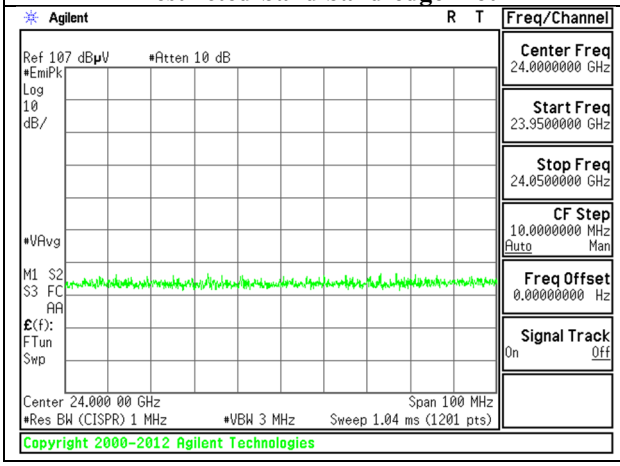
* The test was satisfied the requirements in FCC 15.31(c).

Radiated Emission (Electric Field Strength of Fundamental and Unwanted Emission)
(Reference Plot for band-edge)

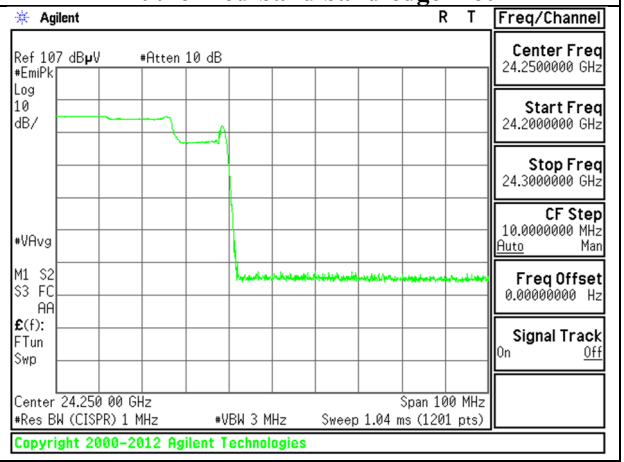
Report No.	14173246H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 22, 2021
Temperature / Humidity	21 deg. C / 56 % RH
Engineer	Yuichiro Yamazaki
Mode	Normal Operating mode

Horizontal

Restricted-band band-edge Plot

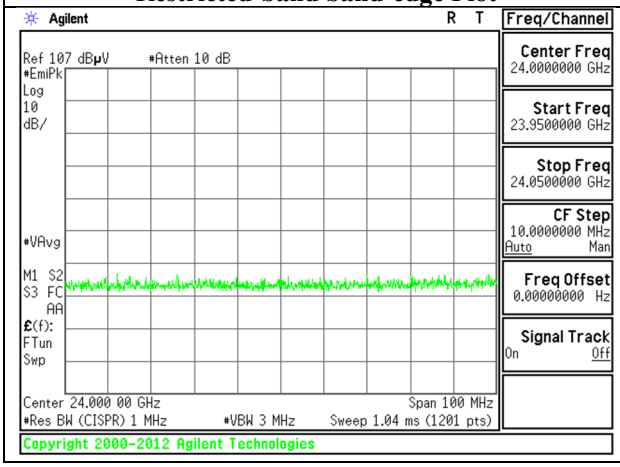


Authorized-band band-edge Plot

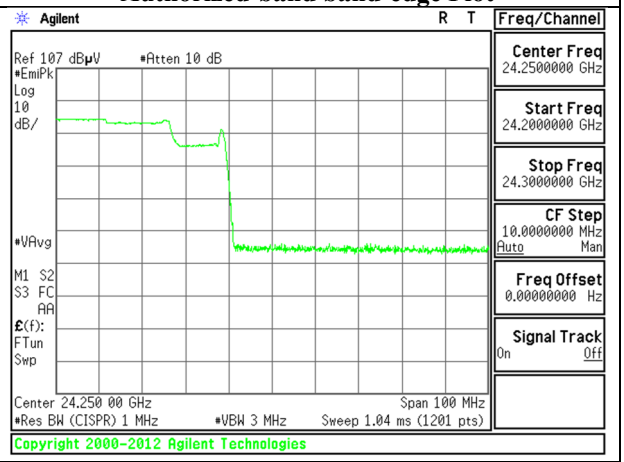


Vertical

Restricted-band band-edge Plot



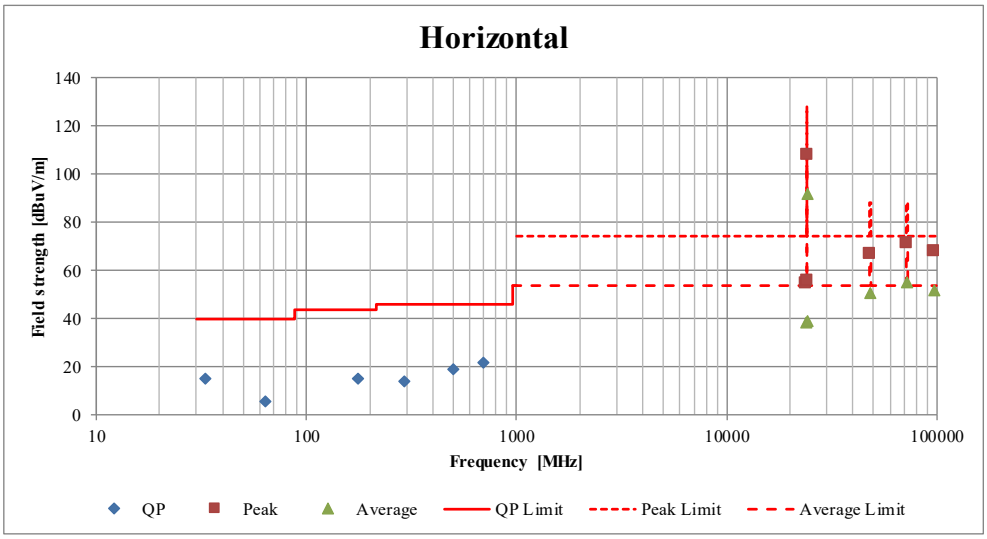
Authorized-band band-edge Plot

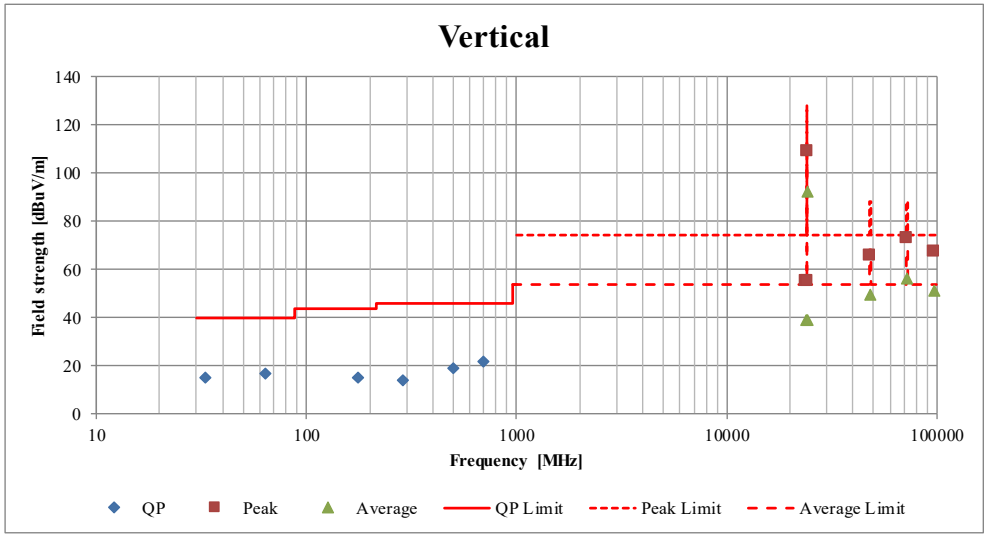


* Final result of restricted band edge was shown in tabular data.

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)
(Plot data, Worst case)

Report No.	14173246H			
Test place	Ise EMC Lab.			
Semi Anechoic Chamber	No.2	No.4	No.4	No.4
Date	November 22, 2021	November 24, 2021	March 4, 2022	March 22, 2022
Temperature / Humidity	21 deg. C / 56 % RH	22 deg. C / 38 % RH	22 deg. C / 36 % RH	22 deg. C / 30 % RH
Engineer	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki	Yuichiro Yamazaki
	(1 GHz - 40 GHz)	(9 kHz - 1 GHz)	(18 GHz - 26.5 GHz)	(40 GHz - 100 GHz)
Mode	Tx			



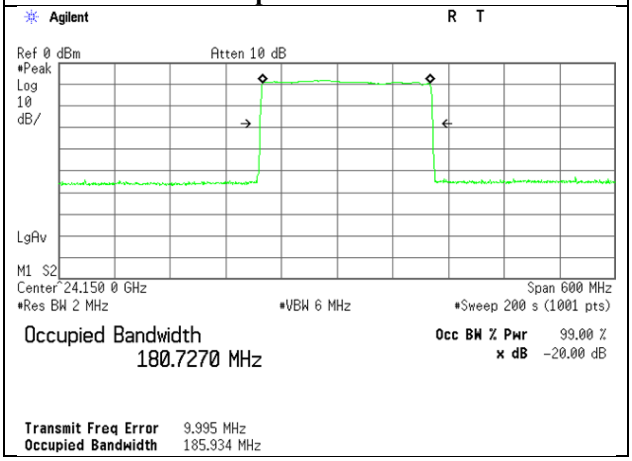


20 dB Bandwidth, 99 % Occupied Bandwidth

Report No.	14173246H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 9, 2021
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuichiro Yamazaki
Mode	Normal Operating mode

Frequency [GHz]	99% Occupied Bandwidth [MHz]	-20 dB Bandwidth [MHz]
24.15	180.7270	185.934

Occupied Bandwidth



Duty Cycle

Report No.	14173246H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 9, 2021
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuichiro Yamazaki
Mode	Normal Operating mode

[Declared data]

[Declared data (typcal)]

Transmission time of each pattern

Frequency	Pattern	On time		Off time	Number of repetitions	Total On time	Total Off time
		1st *1) [us]	2nd *2) [us]	[us]		[us]	[us]
f1	(1)	100	-	200	65	6500	13000
	(2)	700	-	200	2	1400	400
	(3)	100	200	26400	1	300	26400

Calculation:
Total On time = On time * Number of repetitions
Total Off time = Off time * Number of repetitions
Total Period time = Total On time + Total Off time

Transmission time of One transmission period

Frequency	One transmission period			Duty factor
	Total On time [us]	Total Off time [us]	Total Period time [us]	[dB]
f1	8200	39800	48000	-15.35

Calculation:
(One transmission period) Total On time: The total value of Total On time for each pattern
(One transmission period) Total Off time: The total value of Total Off time for each pattern
(One transmission period) Total Off time: The total value of Total Period time for each pattern
Duty factor = 20 * log(Total On time / Total Period time)

*1) 1st on time;
Parttern(1) : CW1
Parttern(2) : CW2
Parttern(3) : CW3

*2) 2nd on time;
Parttern(3) : CW4

Duty Cycle

Report No.	14173246H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 9, 2021
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuichiro Yamazaki
Mode	Normal Operating mode

[Measured data]

Transmission time of each pattern

Frequency	Pattern	On time			Off time	Number of repetitions	Total On time	Total Off time	Total Period time
		1st *1) [us]	CW4 + CW1 *2) [us]	2nd *3) [us]	[us]		[us]	[us]	[us]
f1	(1)	89.16	-	-	208.40	65	5795.40	13546.00	19341.40
	(2)	686.70	-	-	213.00	2	1373.40	426.00	1799.40
	(3)	101.10	303.30	214.14 *1)	26380.00	1	315.24	26380.00	26695.24

Calculation:
Total On time = On time * Number of repetitions
Total Off time = Off time * Number of repetitions
Total Period time = Total On time + Total Off time

Transmission time of One transmission period

Frequency	One transmission period			Duty factor
	Total On time [us]	Total Off time [us]	Total Period time [us]	[dB]
f1	7484.04	40352.00	47836.04	-16.11

Calculation:
(One transmission period) Total On time: The total value of Total On time for each pattern
(One transmission period) Total Off time: The total value of Total Off time for each pattern
(One transmission period) Total Off time: The total value of Total Period time for each pattern
Duty factor = 20 * log(Total On time / Total Period time)

Pattern (1);
CW1 : Since the on-time of 65 times is all the same, the on-time of a certain observation time was measured.
FMCW1 : Since the off-time of 65 times is all the same, the off-time of a certain observation time was measured.

*1) 1st on time;
Parttern(1) : CW1
Parttern(2) : CW2
Parttern(3) : CW3

*2) : Since the Pattern (1) is output continuously after pattern (3), in the figure of “f1 Pattern (3) Zoom” , on time is combined “CW4” and “CW1”. (Fig. f1 Pattern (3) Zoom)
Therefore, on time is CW4 + CW1.

*3) 2nd on time;
Parttern(3) : CW4
the on time of “CW4” is calculated by subtracting the on time of “CW1” from the on time (303.3 usec).

There are two doppler frequencies and chirp part in one transmission period. These doppler parts and chirp part were compared to calculate the duty factor. The duty factor was calculated within doppler part, because doppler's dwell time is longer than the chirp part.

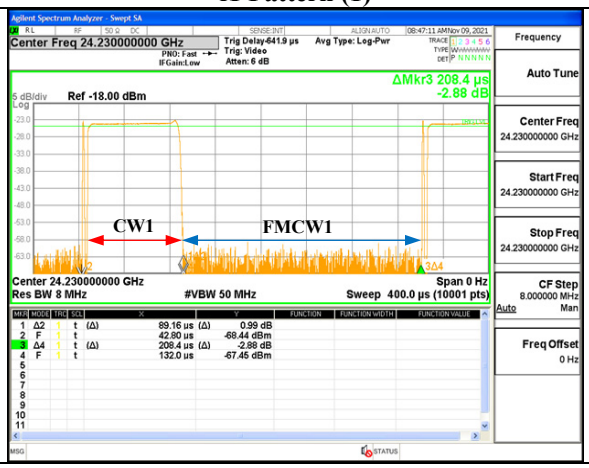
The declared duty factor and measured one were compared. The maximum duty factor of these results was applied to the average field strength measurement. (Worst case)

Duty Cycle

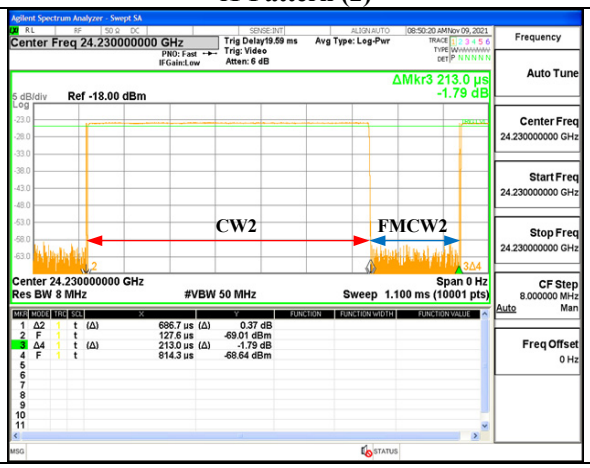
Report No.	14173246H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 9, 2021
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuichiro Yamazaki
Mode	Normal Operating mode

[Measured data]

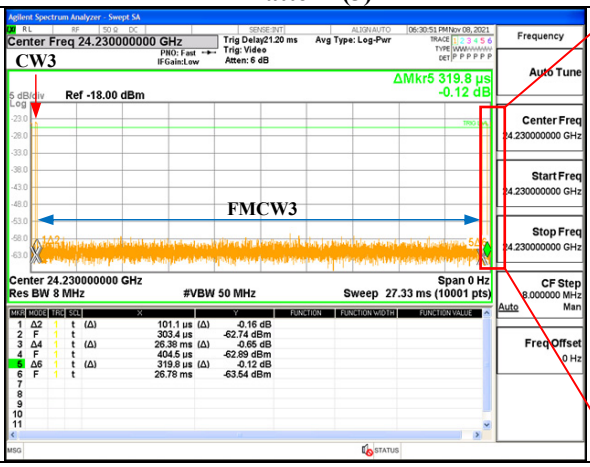
f1 Pattern (1)



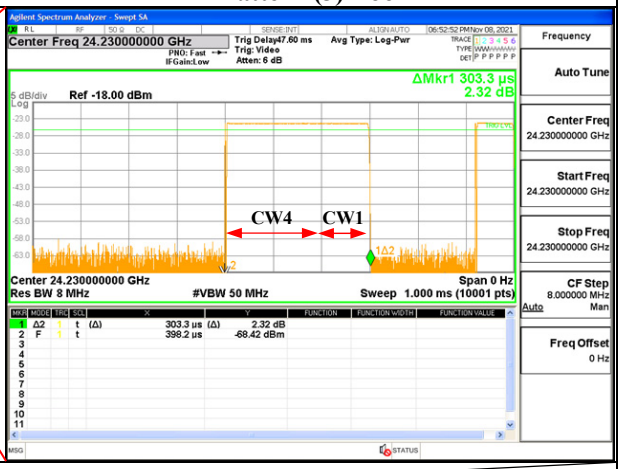
f1 Pattern (2)



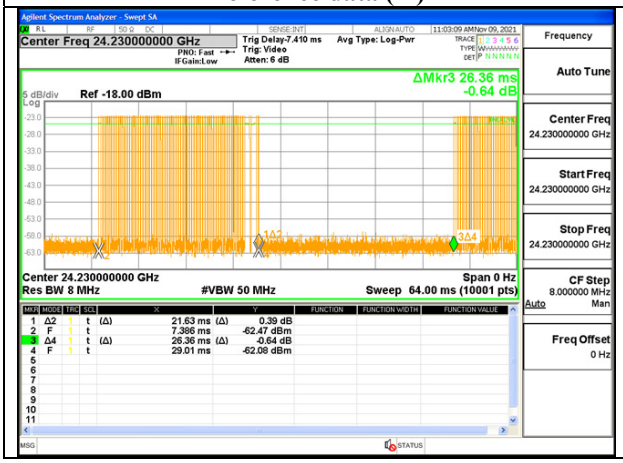
f1 Pattern (3)



f1 Pattern (3) Zoom



Reference data (f1)



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APPENDIX 2: Test Instruments

Test equipment (Tested on November 9 to 23, 2021) (1/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/26/2020	24
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/06/2020	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/10/2021	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/09/2021	24
RE	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	254	10/21/2021	12
RE	MCC-218	141394	Microwave Cable	Junkosha	MWX221	1607S141(1 m) / 1608S264(5 m)	09/30/2021	12
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	02/18/2021	12
RE	MPA-03	141577	Microwave System Power Amplifier	Keysight Technologies Inc	83050A	MY39500610	10/28/2021	12
RE	MCC-220	151897	Microwave Cable	Huber+Suhner	SF101EA/11PC24/ 11PC24/2.5M	SN MY1726/1EA	04/12/2021	12
RE	MHA-02	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/28/2021	12
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9170	BBHA9170306	06/07/2021	12
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/15/2021	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/07/2021	12
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/12/2021	24
RE	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/10/2021	12
RE	MHA-33	180634	Horn Antenna	SAGE Millimeter, Inc.	SAZ-2410-15-S1	17343-01	06/24/2021	12
RE	MPA-23	142055	Power Amplifier	SAGE Millimeter, Inc.	SBP-5037532015-1515-N1	11599-01	03/05/2021	12
RE	MMX-01	142047	Preselected Millimeter Mixer	Keysight Technologies Inc	11974V-E01	3001A00412	11/16/2021	12
RE	MCC-177	141226	Microwave Cable	Junkosha	MMX221-00500DMSDMS	1502S304	03/01/2021	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/18/2021	12
RE	MCC-135	142032	Microwave Cable	Huber+Suhner	SUCOFLEX102	37511/2	2021/09/18	12
RE	MCC-136	142033	Microwave Cable	Huber+Suhner	SUCOFLEX102	37512/2	2021/09/18	12
RE	MHA-35	180544	Horn Antenna	SAGE Millimeter, Inc.	SAZ-2410-10-S1	17343-01	06/24/2021	12
RE	MPA-31	180607	Power Amplifier	SAGE Millimeter, Inc.	SBP-7531142515-1010-E1	17343-01	10/18/2021	12
RE	MMX-02	142048	Harmonic Mixer	Keysight Technologies Inc	11970W	2521 A01909	10/15/2021	12
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
RE	MHA-31	142041	Horn Antenna	Oshima Prototype Engineering Co.	A16-187	1	09/30/2021	12
RE	MPA-25	159919	Power Amplifier	SAGE Millimeter, Inc.	SBP-4035033018-2F2F-S1	12559-01	06/02/2021	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/02/2021	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/28/2021	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	11/03/2021	12
RE	MLA-23	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-192	08/28/2021	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/05/2021	12
RE	MCC-113	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-PE/RFM-E121(SW)	-/04178	06/02/2021	12
RE	MLPA-01	141254	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	04/17/2021	12
RE	MCC-255	207745	Coaxial Cable	UL Japan Inc.	-	-	05/17/2021	12

Test equipment (Tested on November 9 to 23, 2021) (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
CE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/15/2021	12
CE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/07/2021	12
CE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
CE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/05/2021	12
CE	MLS-26	141538	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-732	07/20/2021	12
CE	MAT-67	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/07/2020	12
CE	MCC-113	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/ 421-010/ sucoform141-PE/ RFM-E121(SW)	-/04178	06/02/2021	12

***Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

The expiration date of the calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test item:

CE: Conducted Emission test
RE: Radiated emission, 20 dB bandwidth and Duty cycle tests

Test equipment (Tested on March 4 and 22, 2022)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/10/2022	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/16/2022	12
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/10/2021	12
RE	MCC-257	208936	Microwave Cable	Huber+Suhner	SF126E/11PC35/ 11PC35/1000M,5000M	537061/126E / 537076/126E	07/18/2021	12
RE	MHA-02	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/28/2021	12
RE	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/07/2021	12
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/12/2021	24
RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/10/2021	12
RE	MHA-35	180544	Horn Antenna	SAGE Millimeter, Inc.	SAZ-2410-10-S1	17343-01	06/24/2021	12
RE	MPA-31	180607	Power Amplifier	SAGE Millimeter, Inc.	SBP-7531142515-1010-E1	17343-01	10/18/2021	12
RE	MMX-02	142048	Harmonic Mixer	Keysight Technologies Inc	11970W	2521 A01909	10/15/2021	12
RE	MCC-135	142032	Microwave Cable	Huber+Suhner	SUCOFLEX102	37511/2	09/18/2021	12
RE	MCC-136	142033	Microwave Cable	Huber+Suhner	SUCOFLEX102	37512/2	09/18/2021	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/25/2022	12
RE	MCC-177	141226	Microwave Cable	Junkosha	MMX221-00500DMSDMS	1502S304	03/17/2022	12
RE	MHA-33	180634	Horn Antenna	SAGE Millimeter, Inc.	SAZ-2410-15-S1	17343-01	06/24/2021	12
RE	MPA-23	142055	Power Amplifier	SAGE Millimeter, Inc.	SBP-5037532015-1515-N1	11599-01	03/05/2021	12
RE	MMX-01	142047	Preselected Millimeter Mixer	Keysight Technologies Inc	11974V-E01	3001A00412	11/16/2021	12
RE	MHA-31	142041	Horn Antenna	Oshima Prototype Engineering Co.	A16-187	1	09/30/2021	12
RE	MPA-25	159919	Power Amplifier	SAGE Millimeter, Inc.	SBP-4035033018-2F2F-S1	12559-01	06/02/2021	12
RE	MCC-220	151897	Microwave Cable	Huber+Suhner	SF101EA/11PC24/ 11PC24/2.5M	SN MY1726/1EA	04/12/2021	12

***Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

The expiration date of the calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test item:

RE: Radiated emission test